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WEATHER CONTROLS OVER THE FIGHTING DURING THE SUMMER OF 1918[1]

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IT is obvious that so violent and so critical a series of military operations as those which have been taking place in the western war zone should, as a whole, continue in spite of temporary adverse weather conditions. It is, nevertheless, true that the student of military meteorology finds many noteworthy illustrations of weather controls even during the summer, which is meteorologically the most favorable season of the year for campaigning on the western front. It is to be borne in mind that the Germans had every reason for putting forth their utmost efforts during the spring and summer of 1918, in order, if possible, to gain a decisive victory before the winter should put a stop to active fighting, and before the spring of 1919 should bring the Allies a distinct superiority in man-power owing to the expected arrival of very large numbers of American troops.

May ended and June began with a spell of fine summer weather. The sun was hot, and the roads were deep in dust, which rose like smoke under the feet of the marching troops. Rains, the heavier and the longer-continued the better, were greatly to be desired by the Allied armies. For rain means mud, water-soaked bogs and swamps, and water-filled shell-craters. And rain and mud mean difficulties in the transportation of guns, of ammunition and of supplies. During the German offensive, early in the summer, delays of this sort interfered with the prompt execution of the enemy's carefully-laid plans, and gave added time for the Allies' reserves to gain in strength. Later on, when the enemy was making his forced retirements, bad weather and difficult transportation made it very much harder for the Germans to move back their artillery and ammunition, an enormous amount of which fell into the hands of the Allies. Mr. Philip Gibbs put the case very clearly in a despatch cabled to the New York *Times.*

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[1] Continued from the July, 1918, number of THE SCIENTIFIC MONTHLY.

> Last year in Flanders the rain, that began in August and hardly ceased until the end of November, created such foul conditions for the British troops that rapid progress in attack was utterly impossible, in spite of courage and will power reaching to the very heights of human nature. That was the British tragedy and German luck. Now, for the great offensive in the west, the enemy has again been favored by the weather. All through February and March, when the German armies were massing and making secret preparations for the assault on our line, the days and nights were dry and mild; the ground firm; the roads good, and all conditions favorable for the movement of men and guns. It has lasted like that ever since, with hardly a break, and the splendor of the last two months has given the enemy all the advantage for his plans and organization of attack.

A heavy rain storm on June 9 and 10 was noted as having temporarily delayed the Germans during a new advance, but another spell of fine weather immediately followed, again favoring the enemy by keeping the ground hard and dry. The New York *Times* correspondent, under date of June 13, cabled "the weather still holds good, but if the deluge comes it will for once be in our favor, and the more mud the merrier." After the middle of June (19th to 24th) there was about a week of showery, cloudy weather, but the month ended, and July began, with a spell of fine weather, interrupted, after the usual summer fashion, by showers or thunderstorms, which are noted as having benefited the French crops.

A new German offensive was launched on the morning of July 15. This had been expected for many days. As in previous instances of starting an enemy offensive, it is probable that the time was carefully chosen as a favorable one on the advice of the German meteorological experts, of whom there are reported to be sixty at the front.

The dominant fact in the later portion of the summer campaign was the steady and at times rapid retreat of the German armies. In this retreat, as above noted, rain and mud played an important part. As one correspondent put it (July 23), "there was a heavy rain to-day in the north of France, and each drop of it will alter a little, perhaps, the history of this war. . . . So let it rain."[2] Obviously, bad weather and deep mud also retarded the advance of the Allies, and hampered their artillery fire, as, *e. g.*, during the first week of August. The enforced abandonment of immense quantities of ammunitions and supplies and of many heavy guns by the enemy was, however, a far more critical result of the meteorological conditions. The high water stages of the French rivers were a serious factor for the enemy to deal with. Recent rains had caused a flooding of the Vesle. The German rear-guards could not ford the river and had to fight for their lives. Most of them were killed, and the rest were taken prisoners. The rise of the river seems to have disorganized the whole German plan for protecting the withdrawal of the army. On the other hand, one despatch noted the fact that the Germans also were favored by the weather, which "transformed the banks of the Vesle into swamps and morasses," enabling the enemy to make "a stiffer stand here than was to be expected." The rains, swollen rivers and mud of the first week of August, which retarded the Allied pursuit and prevented them from bringing up their guns, ammunition and supplies, were probably a more important factor in slackening the Allied advance than was the resistance offered by the Germans.

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[2] Philip Gibbs, in the *New York Times.*

Many illustrations might be given of the part played by weather conditions in local engagements. Thus, a German surprise attack, to regain Bouresches, was made on a dark cloudy night (June 13), but had been anticipated by the American troops who realized that the weather was ideal for just such an attempt. A French-American counter-attack along a broad front on the early morning of June 18 was wholly unexpected by the enemy, who had been driven to shelter in his dugouts by a violent thunderstorm which burst shortly after midnight. The noise of the storm drowned out the noise of the Allied barrage fire, and the Allied tanks took up their positions unnoticed. The frequent night fogs of the western front have often played a part in the fighting. On July 15, the Germans on the north bank of the Marne advanced at dawn under cover of a fog. Again, on July 30, a heavy fog favored a German attack on the north bank of the Ourcq. An important combined British and French attack on the German lines between Amiens and Montdidier caused the enemy to retreat on the first day over a front of more than 20 miles. This attack took the enemy completely by surprise. A thick fog had begun to form early the night before, and by dawn had completely covered not only the valleys but the higher ground also. At daylight, the fog "lay so thick it was impossible to see more than 30 yards" in any direction. Following a short but intense artillery preparation, the Allied troops advanced through the fog, taking the enemy completely by surprise. The men in advance of the attacking troops "were met only by rifles and machine guns, firing vaguely through the fog." By nine o'clock in the morning the fog was lifting, but the enemy was in retreat. At dawn on August 21, the British smashed into Gen. von Below's seventeenth army during a heavy fog, on a front extending more than ten miles from the Ancre River to Moyenneville. The infantrymen and the tank crews "could scarcely see 100 ft. ahead of them." The fog was most favorable to the attacking troops, for it effectively concealed them from the eyes of the enemy, who suffered heavy casualties and lost many guns. Some of the British tanks and battalions are reported to have lost their direction, and this led to some confusion, but the advantages due to the fog were far greater than the disadvantages.

In mid-August (14th) "glorious weather" was reported on the Picardy battlefront. The Allied airplanes were able to observe the enemy's movements, and to know where he was concentrating his reinforcements. "Stifling weather" prevailed during most of the fighting around Lassigny (third week of August). The men fought "under a scorching sun"; stripped to the waist. Heavy rains fell late in August, but, in spite of this handicap, the Allied troops pressed on in their general advance.

A part of the responsibility which the United States is taking in the war is the increasing contribution which we are making to the Allied military meteorological service overseas. Several expert meteorologists, commissioned as officers of the Signal Corps, have been in France for some time. Three hundred Army meteorological observers, especially selected, and trained for their work at the Agricultural and Mechanical College of Texas, have recently been sent abroad. The War Department, it is announced, plans to train 1,000 men in all for this highly important service. Once a day a summary of weather conditions over the United States is cabled from Washington to the Headquarters of the American Expeditionary Force in France. The regular forecasts of weather conditions on the western front, based in part upon these observations, are now regularly used by American officers in planning airplane activity, artillery work, and military operations generally. In connection with meteorological activities overseas, it is significant that Sir Napier Shaw, who has for nearly fifteen years been director of the British Meteorological Office, has recently been appointed scientific adviser on meteorology to his government, for the duration of the war.

Although the summer has only just ended, the need of keeping the American troops overseas warm during the damp and chilly autumn and winter months has already been given serious attention. That the lack of an adequate fuel supply in France will lead to much suffering on the part of the men is inevitable. Although many of the American troops are accustomed to much greater outdoor cold at home than they will ever experience on the western front, they are used to *dry* cold, and to warm houses.

The Austrian drive began June 15. Offensive operations had been attempted several times in the late spring, but the lingering snows of winter, snowslides, and deep-flowing mountain torrents prevented any large scale campaigning. A June 7 despatch had referred to the Austrian "spring drive" as imminent, the floods in the Piave, resulting from melting snows, having subsided, but bad weather on June 13 was reported as still hindering operations. The morning selected for the Austrian advance was "more than usually" foggy in the mountain sector. The snow still lying in the mountains was "heaped up into immense mounds by the bombardment," and the Italian troops wore white overalls as a protection in the snow. Bad weather during the next three days limited operations, and the heavy rain helped to minimize the effects of the gases, which were used in large amounts by the Austrians.

The most striking meteorological factor during the whole summer campaign on the Austro-Italian front was the flooding of the Piave River within a few days after the Austrian advance across it. This flood, the result of the heavy rains which fell for about a week in the mountains and on the Venetian lowland, turned the river from a by no means formidable military obstacle into a rushing torrent. Thirteen out of fifteen pontoon bridges built by the enemy were swept away. It thus became extremely difficult, if not altogether impossible, to supply such of the Austrian troops as had crossed to the western bank (reported as numbering about 40,000) with reinforcements, artillery, ammunition and food. In fact, the troops on the western bank were soon completely isolated, such bridges as were not swept away by the flood being bombed by British and Italian aviators. One report noted that the isolated Austrians were for a time fed by means of airplanes. In the face of persistent Italian counter-attacks, with their bridges washed away or destroyed, and all efforts to rebuild them proving futile, the enemy was obliged to recross the raging Piave under the most difficult and dangerous conditions, in great disorder, all along the line from Montello to the sea. Thousands of the enemy were drowned, or shot in the water. The Austrian loss was put at about 200,000 killed, and 20,000 taken prisoner. The defeat of the enemy on the west bank was complete, and the Italian line was restored up to the water's edge. The Austrian War

Office, under date of June 24, announced: "A position has arisen by reason of the height of the water, and bad weather, which has caused us to evacuate Montello and some sectors of the other positions which we had won on the right bank of the Piave." Answering criticisms on the subject of the retreat, made in the Hungarian Parliament on June 29, Major Gen. von Szurmay, Minister of National Defence, said: "No one could have foreseen the heavy rain which caused the Piave to rise."

It is, however, manifestly unfair to the splendid work done by the Italian armies to leave the impression that the Piave floods alone were responsible for the Austrian retreat. The enemy's advance was doubtless checked before the floods began. The latter, however, made it impossible for the Austrians to keep anything that they had previously gained on the west bank. It was natural enough that the Austrians should have attributed their defeat to nature, and not to their opponents. Thus, a war correspondent of the Vienna *Neue Freie Presse* (July 2) said, "not the Italians, but the rain triumphed. Nature," he continued, "interposed its inexorable and cruel veto."

There is little to record regarding the operations in the Balkans. Bad weather was stated in several of the early summer despatches to be responsible for the inactivity. Regarding the Allied operations in Albania, a Paris War Office despatch of July 24 said: "Our attacks have succeeded by reason of perfect preparation and the bravery of our troops, who, in the course of engagements carried out sometimes in snowstorms and sometimes under an unbearable sun in a very difficult country, have by their skill and resolution taken indisputable ascendency over their adversary."

The important war activities on the former eastern (Russian) front have been in connection with the landing of Allied troops on the Murman Coast. This northern region gains its chief importance because it has an ice-free port, the result of the presence of a warm ocean current (Gulf Stream drift) alongshore. From this port, a railroad of strategic value runs to Petrograd.

No large-scale military operations have been reported from Mesopotamia, where the heat of the summer is such as to make active campaigning extremely difficult and dangerous. In spite of many climatic and topographic handicaps, however, a British force succeeded in reaching Baku early in August, but details of this march are not yet available. They will be of very unusual interest when they are made public. As fuller information comes to hand regarding the earlier operations in Mesopotamia, the extraordinary difficulties under which the British Expeditionary Force has been carrying on its important and almost forgotten advance in that land of heat, and dust, and floods, stand out in a clearer light. No correspondent has had a better opportunity to see what has actually been accomplished by the British forces in Mesopotamia than Mrs. Eleanor Franklin Egan, whose admirable articles in the *Saturday Evening Post* have given a vivid and accurate picture of the country itself, as well as of the activities of the British Expedition. Mrs. Egan notes that in a book of instructions to British officers regarding equipment for Mesopotamian service the following advice is given: "To spend a year in this detestable land you will require three outfits of clothing—one suitable for an English winter; one suitable for an English summer, and an outfit suitable for Hades." In Mesopotamia, "climate gets more attention than any other one thing, and it is the first thing to be taken into consideration in every move that is made." During the late spring, summer and early fall, temperatures of over 110° F. are regularly reached, and under canvas the thermometer often reaches 130°. No records are available of the loss of life due to the heat during the first campaign in 1915, when no adequate preparations to meet this inevitable emergency had been made, but in the summer of 1917, 519 men of the Expeditionary Force died of heat and sunstroke, in spite of every possible precaution. Ice plants are now provided wherever there are British troops. Every hospital has a special sunstroke hut or tent which is always kept ready for the instant treatment of all cases. Sun helmets and "spine pads" must be worn throughout the hot months, and not until some time late in November do the orders of the day give the British soldier permission to leave these off after four o'clock in the afternoon.

In striking contrast with the intense heat and dryness of the Mesopotamian summer are the spring rains, and the floods resulting from the melting snows far up in the Armenian mountains. These floods, spreading far and wide over the lowlands, played an important part in the early days of the expedition, and are to be expected every year at about the same time. "Nobody who has ever lived through a spring and early summer in Mesopotamia," says Mrs. Egan, "doubts the story of the Flood." Another meteorological feature of this desert, as of other deserts, is the mirage. In the early days of the Mesopotamian campaign there was one engagement in which a mirage played a conspicuous part in turning the fight to the advantage of the British. The latter were being hard pressed. Their commanding officer was on the point of ordering a retirement, when suddenly the enemy were seen to be in full retreat. The Turkish commander, deceived by a mirage, saw what seemed to him to be heavy British reinforcements approaching, and directed his troops to retreat at once. It was only a British supply and ambulance train, "magnified and multiplied by the deceptive desert atmosphere." The Turks stampeded, and were pursued by bands of nomadic Arabs for a distance of nearly ninety miles across the desert. It is reported that the Turkish commander discovered his mistake a few days later, and committed suicide.

From Palestine there have been no reports of either military or meteorological interest. Doubtless there, too, military activity has been greatly curtailed by the heat and drought of the summer. One belated communication, from Jerusalem, notes the fact that the winter (1917–18) was "long and cold—so the poor Tommies think. But it has been the best winter since the war set in. We have had no snow."

In aviation, it is increasingly evident that weather conditions which earlier in the war were regarded as prohibitive for flying, are now interfering less and less, at least so far as bombing is concerned. High winds, low clouds and fog, and heavy rain, decidedly lessen aerial activity, and spells of fine weather always greatly increase it, yet month by month, as the reports come in, it is evident that in the intensity of this modern warfare, flying must be done in practically all weather. Nevertheless, aerial reconnaissance and photography, and direction of artillery firing from airplanes, can not be effectively carried out unless there is a reasonably clear view of the ground. The advantage which the prevailing westerly winds give to the enemy aviators on the Western Front is readily recognized. A London despatch, dated July 23, notes that

> the weather admittedly plays an important part in the defense of England against German air raids. The time will shortly arrive when more or less settled conditions can be expected to prevail, and with the approach of that date speculation grows keen as to what "the long-range bombing season" is likely to bring forth.

One of the new developments in aviation is "cloud formation flying," which has been decribed by Brig. Gen. Charles Lee, of the British Aviation Mission now in this country.[3] "Cloud flying is to-day a necessity," although until recently pilots have hesitated to go into clouds except for defensive purposes. The machines go in formation through the clouds, meeting again above the clouds. There the formation is continued on a compass bearing to the objective. The machines then come down through the clouds; bomb the objective; go up again, and come home.

[3] *New York Times,* August 18, 1918.

The use of gas shells, instead of the clouds of chlorine gas which the Germans so generally employed in the earlier days of the war, has in no way overcome the importance of the wind direction as a factor in a successful gas attack. There are several reports of a change of wind during a gas attack, which drove the gases back to the enemy lines. On June 10, on the western front, "the wind changed its direction, and tens of thousands of poison gas shells fired by the Germans did more damage to themselves than to the Allies." On July 15, a Paris despatch noted the favorable weather conditions which prevailed for the Allied armies.

> For once the Germans are not favored by the elements. The sky is overcast, the weather is unsettled, and, most important, the wind is southwest. This is a vital gain for the defense, for it makes it difficult, if not impossible, for the Germans to make extensive use of gas, on which they usually count. Cohesive action is out of the question when troops are muzzled for long hours with masks. Officers can not communicate orders, and each man is thrown on his own resources. As a result, weight of numbers, which is always on the side of the attacking army at the beginning, becomes the deciding factor.

Again, on August 6, in the Fismes sector, a change of wind to the south blew the gas back from the American lines and towards the enemy.

In connection with gas attacks in general it is worth recording that at the very beginning of the use of gas clouds the importance of a knowledge of the wind direction was recognized by the British and French troops in the trenches. Various devices were employed to serve as wind vanes. Anything that could easily be seen by the enemy naturally drew fire. A simple vane was then devised, consisting of a stick with a thread about a foot long fastened at the upper end of it, and with a small piece of cotton wool at the end of the thread. The strength of the wind was indicated by the rise of the cotton wool from a vertical position. Night was soon found to be the best for chlorine gas attacks, because the moving air then has a greater tendency to flow down any slopes, and to keep the gas cloud near the ground. By day, on the other hand, the general tendency of the air is upward, and this is likely to dissipate the gas.

The question of the most favorable weather conditions for the use of gas, and for general military operations on the western front, is one which can easily be answered by any one who has some knowledge of European weather types. The Germans want a weather type distinguished by high pressure over northern or northeastern Europe. This gives them clear skies, and generally light *easterly* winds, blowing toward the Allied lines. This is a fairly "settled" weather type. It comes on slowly, and the German meteorological experts, with the help of such weather maps as they are able to construct, can usually predict the continuance of this weather type for several days. This is, doubtless, one of the principal reasons why the Germans have on the whole so distinctly had the best of the weather situation ever since the war began. On the other hand, the Allies on the western front need southwesterly winds for their gas attacks. These usually occur during the passage of an area of low pressure; are therefore apt to be of fairly high velocity, and to be accompanied by clouds and rain. Furthermore, this type is characteristically of rather short duration. The advantage in this matter thus clearly lies with the Germans. At the end of August it was noted that the Germans were using little gas because the wind was unfavorable.

The destruction, by Commander Rizzo, of an Austrian battleship[4] off the Dalmatian coast early in June was favored by a fog, which prevented the attacking Italian motor boats from being seen as they worked their way through the screen of enemy destroyers. In our own waters, the German submarine which attacked an ocean-going tug and its convoy of barges off Cape Cod on July 21 approached unseen in a fog.

The importance of the food supply of Germany as a factor in the duration of the war gives interest to all reports regarding the German and Austrian crops, although too much weight should certainly not be laid on the cabled news. An Amsterdam despatch of June 7 mentioned a "sudden cold wave" over Central Europe, with severe frosts, which caused widespread damage to grain, fruit and potatoes. In a despatch from London, June 27, reference is made to *snow* from one to three inches deep in several parts of Germany. From Zurich, July 5, a report comes of violent rain-storms and abnormally low temperatures in Austria-Hungary, with "severe snowstorms and frost in Bosnia, Herzegovina and Dalmatia." The snowfall continued for several hours, and greatly damaged the crops. It may be noted in connection with these reports of snow in summer, that brief snowfalls, coming chiefly in thunderstorms, are not uncommon on mountains and high plateaus, even in the hottest season of the year. Later Amsterdam and Zurich reports (July 8 and 10) mention severe floods in many parts of Austria and Southern Germany. The Danube at Vienna reached the highest level in thirty years. A more detailed report (July 22) notes that in Germany spring drought and heat were followed by frosts early in June, one third of the potato crop being killed and other vegetables and fruits being severely affected. Trade reports generally agreed in saying that the crop outlook in both countries was unfavorable.

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[4] Probably two battleships were destroyed.